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ABSTRACT

The Internet is a growing source of information for persons worldwide, but for many people with disabilities the Internet can be a confusing jumble of images, frames, scripts, and colors that make little sense. Although learning how to make Web pages accessible to all takes some effort, it is effort well spent for one very good reason: accessibility is for everyone. This document gives a brief overview of the two main laws related to accessibility (the Americans with Disabilities Act and Section 508 of the Rehabilitation Act). It then addresses the 14 guidelines developed by the Web Accessibility Initiative (WAI). Finally it identifies free resources for Web page designers. (Contains 25 references and resources.) (Author)

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Designing Web Pages That Are Usable and Accessible To All

by
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Chapter One

Designing Web Pages That Are Usable and Accessible To All

Joe E. Wheaton and Paul F. Granello

The Internet is a growing source of information for persons worldwide, but for many people with disabilities (especially visual disabilities) the Internet can be a confusing jumble of images, frames, scripts, and colors that make little sense. Anyone who has spent any time at all on the Web has encountered text that is barely visible against the background, links that tell you nothing about what will happen when you "click here," and pages that go beyond the edges of the screen. It takes little imagination to conceptualize what these features must be like to a person who cannot see the screen. To acquaint yourself with the problem, turn off the images in your browser and link to some of your favorite Web pages (To do this, click on *Tools*, then on *Internet Options*, then *Advanced*. Now scroll down to *Multimedia* and uncheck the *Show Pictures* box. If you are on a web page, you will need to *Refresh* it. Also, depending on how you have your browser set up, you may still see pictures on the pages you most recently visited because they are loaded from your cache.). Try several pages and follow some of the links to other sites on the Web, and see if you can interpret them.

What you are witnessing is one of the most common problems on the Web and one of the easiest to fix, yet it remains commonplace. Another way to conceptualize what a person who is blind "sees" when reading a Web page is to imagine a radio announcer of a baseball game. The announcer needs to describe all the action to a person who cannot see the game. Good radio announcers can make the game come alive. The goal of a good Web page designer should be to make your pages come alive for your audience, regardless of their physical or mental abilities.

Although learning how to make Web pages accessible to all takes some effort, it is effort well spent for one very good reason: accessibility is for everyone. What does that mean? Creating accessible Web pages is making better Web pages, which are Web pages that will convey your message clearly and succinctly to the widest audience. There are, of course, legal requirements that Web pages be accessible, but those currently only apply to persons or organizations wishing to contract with the federal

government, although eventually these legal requirements may expand to Web sites providing a public service (such as university courses). Nevertheless, persons wishing to get their message to as many people as possible will find that the accessibility guidelines offer the best way to ensure this happens.

This chapter gives a brief overview of the two main laws related to accessibility (the Americans with Disabilities Act and Section 508 of the Rehabilitation Act). We then address the 14 guidelines developed by the Web Accessibility Initiative (WAI). Finally, we identify three resources for Web page designers.

Legal Background

In 1992, the Americans with Disabilities Act (ADA) officially went into effect (Americans with Disabilities Act of 1990). Although the ADA says nothing about Web pages per se, it does mandate that commercial establishments, public accommodations, and telecommunications (in the act these are mainly telephones) must be accessible. Moreover, the ADA mandates that state and local governments must make "programs accessible to individuals with disabilities and [provide] equally effective communications" (U.S. Department of Justice, 1991, Title II, Summary section), although "effective communication" was left largely undefined. Whether the Web pages of commercial establishments and public accommodations are covered under the ADA has yet to be decided by the courts, but it seems logical that the same rules would apply to both the "bricks and mortar" establishment and the "virtual" establishment on the Internet. It also follows that if state and local governments must conform to Section II of the ADA, then pressure will grow for others to do the same.

Although the ADA has served as the basis for specific guidelines for buildings through the ADA Accessibility Guidelines for Buildings and Facilities (ADAAG; http://www.access-board.gov/adaag/html/adaag.htm), it does not provide such guidelines for Web pages. However, Section 508 of the Rehabilitation Act (http://www.access-board.gov/adaag/html/adaag.htm) now supplies the specifics for Web pages. Section 508 says that federal employees or members of the public seeking information from the federal government shall have the same access to such information as persons without disabilities, provided that doing so does not create an "undue burden" to the agency:

> [When] Federal agencies develop, procure, maintain, or use electronic and information technology, they shall ensure that the electronic and information technology allows

> Federal employees with disabilities to have access to and use of information and data that is comparable to the access to and use of information and data by Federal employees who are not individuals with disabilities, unless an undue burden would be imposed on the agency. Section 508 also requires that individuals with disabilities, who are members of the public seeking information or services from a Federal agency, have access to and use of information and data that is comparable to that provided to the public who are not individuals with disabilities, unless an undue burden would be imposed on the agency. (Architectural and Transportation Barriers Compliance Board, 2000)

Some might say that Section 508 will have little effect on most Web pages as only a handful of individuals and very few companies have pages that will be impacted. Although this probably is true, Section 508 has other far-reaching effects. The greatest such effect may be through heightening awareness of the issue of accessibility. This is important in that making Web pages accessible is more a matter of awareness than technical skill (Paciello, 2000). For example, Wheaton, Chovan, O'Briant, and Howell (2001) examined 80 "welcome" pages (the first page of a Web site) using a validation program called Bobby (more about Bobby at the end of this chapter). They found 64% of the pages failed to meet minimal accessibility standards but that most of the errors were relatively easy to repair. For example, the most common error was poor contrast between text, images, and background. This type of error is not only easy to repair, it illustrates the need for simple, good Web page design skills that improve the Web for all readers.

A second far-reaching effect of Section 508 is that now standards exist for defining accessible Web pages. With the approval of the accessibility standards related to Section 508, courts now have specific guidelines that define accessibility. Consequently in the future we may see the Section 508 standards expanded to include the Web pages of the states, businesses, and universities doing business with the federal government much as the other sections of the Rehabilitation Act apply to these entities. If this prediction is true, Web page designers would be well advised to create accessible Web pages now, which is always easier than fixing poorly designed Web pages in a rush to comply with new standards.

In the next section we present guidelines for Web page development advanced by the Web Accessibility Initiative (WAI; http://www.w3.org/WAI/). The Web Accessibility Initiative is dedicated to promoting the

development of accessible Web pages through training and research. It has identified 14 primary areas that need to be addressed to make pages accessible. And although most Web pages are not accessed using screen readers or text only browsers, the WAI guidelines improve the rendering of Web pages for all users. Moreover, the Web is now being accessed by devices much different than the traditional monitor attached to a computer and these new devices bring additional demands for Web page authors. For example, WebTV uses a low-resolution monitor (the television screen) and the PDA (personal data assistant) uses a very small screen to view pages that arrive to the device over low bandwidth. Thus, Web pages that are accessible will demonstrate good Web design principles and well-designed pages will be viewable by the greatest number of users.

Before discussing the WAI guidelines, a brief overview of screen readers may be helpful to readers unfamiliar with this technology. Text on the computer screen can be translated into speech by specialized software called screen readers. There are general screen readers that read everything on the screen including the icons on the desktop, email, and word processing documents (e.g., JAWS) and programs for reading only Web pages (e.g., HomePage Reader). These commercial products are becoming more sophisticated and can work with many design elements such as tables and frames. There are also text only readers such as LYNX (http://lynx.isc.org/release/) although these are less widely used.

We advocate making Web pages accessible through two methods: changing the interface and changing the user. In the next section we discuss the former, using the guidelines from the Web Accessibility Initiative as our guide. Then we discuss ways of "changing" the user by providing relevant information about your Web site that demystifies its structure and content.

Changing the Interface: Web Accessibility Initiative Guidelines

1. Provide Accurate Alternative Text for Audio/Video Images

For our purposes, audio/video representation will be defined as either static images (photos, icons, charts, drawings, etc.) or as movable images (e.g., video). To persons using screen readers, or for those with images turned off (a common practice for persons on slow connections), images either do not show up at all or can be very confusing. Failure to correctly identify images is probably the most widely cited error in Web page construction; it is also one of the easiest errors to repair. To make images identifiable means to provide alternative text for each image. All the major Web authoring tools have a method of providing an "alt-tag" but

to be helpful the tags must be meaningful. Depending on the importance of the image, the author can choose to have the image skipped, give a short description, or provide a link to a longer description. When would you do each? In cases when authors use images in layout as spacers, adding an alt-tag that says "spacer" is just extra verbiage and adds nothing to understanding the site. Such images can be "skipped" by placing a single space as the alt-tag. A short description (usually less than 256 characters) might be used for an image that is worth knowing about but can be easily described. Company logos often meet these criteria. Another use of a short description can be a picture of a person. Unless it is critical that everyone know you are bald, wear a beard, or have a tattoo on your nose, then simply saying "Picture of Ms. Jones" is sufficient.

There are, however, images that are central to understanding important content. Graphs, for example, are rendered as images on a Web page and this is critical information that readers need to know. There are two ways to address this problem; probably the safest way is to use both (redundancy can be a virtue). The best way is to provide an explanation of the graph on the Web page, preferably before the graph. Placing the description before the graph tells readers the importance of the graph and its interpretation before they encounter it. After the explanation, they can then refer to the graph for clarification. The advantage of placing the explanation on the Web page is that everyone can benefit from the explanation. Graphs (and tables too) can be difficult for many persons, regardless of ability. Additional information is almost always helpful.

A second method of providing additional information to critical visuals is through the long description tag (LONGDESC tag or the D-link). These links refer the reader to a separate page where additional information is given about the image. This requires creating another page and inserting the link. The reason why this might be used in addition to the description on the original Web page is because you can provide information specific to the layout of the graph (in this example) that would be obvious to a person with vision. Such information might include details about the scaling, number of increments on each axis, etc.

Using a link to a new page raises the issue of whether to open new pages in the same window or in a new window when making links. Generally we believe it is better to have the new page open in the existing window and telling the reader to return to the main page by hitting the browser's "Back" key or the Alt-Left arrow key combination. We believe there is less chance for confusion or of the reader becoming lost if this method is used. There are, of course, times when it is advantageous to open a link in a new window. Persons who use frames to layout their

pages might find readers prefer to have links open in new windows so the whole page can easily be seen and printed (we should add that we do not recommend the use of frames for many reasons and discuss them here only as an example). When opening pages in new windows, however, you must tell your reader this will happen. Otherwise multiple copies of the browser will be open and navigation back to the original page may be difficult.

So far we have been talking about static images (photos and graphics), however video will probably become increasingly common as the technology improves and bandwidth increases. Video requires a special alt-tag, if you will – captioning. We are all familiar with captioning on television programs and all televisions currently manufactured in the United States must include captioning ability. Captioning can be accomplished by many of the video editing programs, but free captioning software (called MAGpie) can be downloaded from the public TV station, WGBH, in Boston. (http://ncam.wgbh.org/Webaccess/magpie).

Not surprisingly, captioning is much more complex and time consuming than creating an alt-tag for a single image, but the effort is worth it. Captioning benefits many more people than just those with hearing impairments. Persons for whom English is a second language, persons with learning disabilities, and anyone who has trouble following interactions are helped. Finally, the audio quality of some recordings is less than what might be hoped for, and in such instances, captioning aids in interpretation.

2. *Don't Rely on Color Alone To Convey Information*

The key design point here is to make text and background contrast and not of a similar hue. A corollary to this is to avoid using images as background for your page. Even faint watermarks add little to the page design other than clutter and increased download time. Finally, information should not be conveyed using color. For example, some fields on forms may be required. Do not designate these fields using color alone (an asterisk works just as well) because color can render differently on different monitors and, of course, is useless to persons with color blindness. The WAI advises checking your page by photocopying it several times. Can you still identify the required fields?

3. *Use Markup & Cascading Style Sheets Properly*

There are several HTML (hypertext markup language) codes that format the text in certain ways, but these should not be used as formatting shortcuts. For example, authors can use headings to increase font size

and boldness. but if a reader is using specialized software that helps organize the page, headings used for formatting can become confusing. Style sheets are becoming more common as a method of identifying formatting, but they are not readable by early browsers. Consequently, make sure the page will still display properly if the style sheet is turned off.

4. Clarify Natural Language

To persons just beginning to develop Web pages, the question might be asked, "What is natural language?" The answer is the languages of humans: English, Chinese, French, etc. You should identify the predominant natural language for the entire document by changing the <html> tag at the beginning of the document to <html lang="en"> (if English is the language, of course), and then note any language changes in the document, when they occur. For instructions specific to several types of Web authoring tools, see the Web Accessibility in Mind Web site (WebAIM; http://www.Webaim.org/howto/). Identifying the natural language allows screen and Braille readers to set themselves to use a given language and also helps search engines find pages being sought and generally improves page readability.

5. Identify by Column and Row Headers and/or Summarize Contents of Tables.

Tables have two uses on the Web: to convey data and for layout. The use of tables for data is commonplace, but in terms of accessibility, several cautions are in order. For data tables to be accessible, the column and row headers need to be identified. This can be accomplished by adding a "header" tag and an "id" for each header cell. Fortunately, this can be accomplished easily with the major Web authoring tools such as Dreamweaver or FrontPage. Labeling a cell as a header cell will center it and make the text bold. We need to add, however, that creating tables that can be read with older screen readers is tedious and probably not worth it, even for very simple tables. We suggest summarizing the table instead, similar to our advice about graphs. A table summary not only makes the information in the table available to all, it ensures that important points are identified. Fortunately, new versions of the screen readers have the ability to identify the row and column header associated with any cell, making tables accessible to those who have the software. Even more than failure to include alt-tags on images, using tables for layout is one of the most common guidelines violated. Early screen readers read table data not cell-by-cell, but line-by-line, as though

the text was not in a table but merely printed across the page, which was impossible to comprehend. Current versions of JAWS and HomePage Reader (the software mentioned above) read tables cell-by-cell, vastly improving readability. Nevertheless, for tables to render properly, the cells should make sense when read across the page, "linearized," and read in order.

6. *Ensure That Pages Using New Technology Transform Gracefully*
Transforming gracefully means "still readable." New technologies include Java applets and ActiveX scripts. The WAI gives a rather mixed message on this guideline. On the one hand, the WAI wants authors to use new technologies, but on the other hand it recommends making the pages backward compatible. These scripts can perform a multitude of tasks (e.g., dropdown menus), but they are not viewable on PDAs, text-based browsers, or older browser versions. Consequently, authors are often left with the need for a separate page that is compatible with the older version.

7. *Give Users Control of Time Sensitive Content Changes*
Time sensitive content is content that appears only for a short amount of time or that starts by itself, without input from the user. It is always good Web page design to let users control what they see and when they see it (Pearrow, 2000). Many of us read Web pages slowly or scan for certain features. Starting animations when bandwidth is limited may cause a computer to crash and jingles that repeat endlessly can be annoying. Moreover, some persons with epilepsy find frequencies between 4 and 59 flashes per second can cause seizures.

When Web pages move to new servers or have been renamed, it is helpful to provide a link to the new page, but allow your viewer the option of when to click the link. They then have time to reset their bookmarks and favorites to the new page.

8. *Ensure Accessibility of Embedded User Interfaces*
Like any specialty, Web design has its own vocabulary. Embedded user interfaces with such things as scripts (e.g., Java scripts). This guideline means that if you use scripts to perform a task (drop down menus, for example), be sure to have an alternative (a site map or text only menu).

9. *Design for Device Independence*
This requirement is becoming increasingly important as nontraditional devices such as PDAs and wireless telephones become more common.

For example, as of the writing of this chapter, there was no browser for the Palm operating system, although pages can be viewed on Palm compatible devices, but these pages have neither graphics nor can they run scripts. As different types of devices become more common, this guideline will become increasingly important.

10. Use Interim Solutions

The essence of this guideline is that you need to provide backward compatibility with older browsers. Although not explicit in the title, this guideline addresses problems caused by adding new technologies without giving the user control. A perfect example is the pop-up window. Such windows can be just an inconvenience for most of us, but for a person using a screen reader, it can be very confusing. If there are several copies of the browser open, finding out where you are can be a distinct problem if you cannot see the screen. There are times, however, when it is advantageous to open a new window. If you need to open a new window, inform the user that this will happen. It is also useful to explain how to return to where they began. Adding the parenthetical phrase after the link "Opens new window. Close the window to return to this page" helps eliminate confusion.

11. Use the World Wide Web Consortium (W3C) Technology and Guidelines

The W3C is the group that sets standards and guidelines for developing content for the Internet (http://www.w3.org/), and the WAI is part of the W3C. The W3C tries to incorporate assistive technology into its innovations. If you cannot use W3C technology, then an alternative version should be available (usually a text only page), but remember to update this page whenever the main page is updated.

12. Provide Content and Orientation Information

This guideline is another example of how accessibility has as its core good Web design. This guideline and Guideline 13 help all readers. Essentially, provide organization to your page that makes reading and finding information easy. One simple concept to remember is to title every page at your site. If you use frames, be sure each has a meaningful title and provide an overview of how they link together. We like to include a "Help for screen readers" link at the top of our home page. This link goes to a text page that gives some general information about the site and how it is organized.

13. Give Clear Navigation Mechanisms

Navigation mechanisms include: navigation bars (links to the most important parts of a page), site maps (a global view of page or site organization), and tables of contents (lists and links to the most important sections of a site or a page). A common mistake that many designers make is using "click here" as a link. Many people scan a Web page quickly for links. When scanning, links that clearly define where they go are much more helpful. Moreover, screen readers have the ability to list all the links for quick navigation. Obviously, a list composed of phrases like "click here," "here," and the like, is useless. Vincent Flanders describes navigation that provides little information as "mystery meat navigation" (Flanders & Peters, 2002). Don't let this happen to you.

14. Make Documents Clear & Simple

This guideline is probably the most useful and probably should be guideline number 1. If you follow this guideline, many of the others will fall into place naturally. This seems simple but is probably deceptively so. Some suggestions include using headings to help readers organize the page, keeping links clear and concise, checking the reading level of your page using your word processor, and generally applying all the guidelines listed above.

Although some of the WAI's guidelines may seem esoteric, we iterate that they are the basis of basic, good Web page design. Providing contrast between text and background, providing alternative text for images, making links clear and concise, and avoiding the latest "gee-whiz" products are examples that all Web page designers should follow. And all are simple to implement. Thus, the WAI guidelines prove once again that "Accessibility is for everyone."

Validation: Is My Web Site Accessible?

Although not one of the guidelines from WAI per se, we suggest that Web authors take advantage of several free validation tools. These tools can automatically check your pages for accessibility, but they only do half (or less) of the job – they cannot replace a human checking the content. We recommend two validation programs in particular:

Bobby, from the Center for Applied Special Technology (http://www.cast.org), and *A-Prompt* from the University of Toronto's Adaptive Technology Resource Centre (ATRC) and the TRACE Center at the University of Wisconsin (http://aprompt.snow.utoronto.ca/). Although both these validation tools use the WAI and the W3C guidelines as the basis for

their verification and can also check for Section 508 compliance, they work slightly differently.

- *Bobby* (http://www.cast.org/bobby) can either be downloaded for a fee (if you wish to check a whole Web site or multiple pages quickly), or a Web address can be typed directly into the *Bobby* Web page and analyzed on the Web. The latter method is free and is especially useful if you have only one page to check. The output from *Bobby* identifies the error and refers you to the WAI guidelines with information about how to repair the problem and the rationale for the repair. Repair will often require some knowledge of HTML or at least familiarity with a Web page authoring tool.
- *A-Prompt* (http://aprompt.snow.utoronto.ca/) currently cannot be run from the Internet but must be downloaded (for free) to your computer and then each page can be analyzed. *A-Prompt* has the distinct advantage of not only identifying the error, but also taking the user through tools designed to fix it. This is extremely helpful to newer Web page authors.

Both tools rely on human checks of content to identify items that cannot be verified by the computer. Thus, familiarity with the WAI Guidelines is necessary. Fortunately, a good method of learning the guidelines is to check several of your Web pages and follow the instructions from *Bobby* or *A-Prompt*. Thus, using these tools increases your knowledge of accessibility, HTML coding, and good Web page design.

"Changing" The User

We recognize that "changing" the user, in the sense of returning vision to someone who is blind or giving fine motor dexterity to someone who has athetoid cerebral palsy, is impossible. What we mean instead is changing the user's *knowledge* of the Web site. We advocate providing information to the user through specially designed help pages and links within your page. One method of doing this is by providing a link to a "Help for Persons Using Screen Readers" file. Such a file would contain information about the layout of the site and information about specific pages, if needed. Such a page would typically be linked from the home page, but could be linked from other pages if the need arose.

On individual pages, such an information section could be created at the bottom of the page so that multiple "Help" pages would not be necessary

and to facilitate the updating of the information. (One method of making a site accessible is to have alternative, text-only pages that contain all the information as the home page but with the graphics. The obvious problem is synchronizing both pages.) In both instances Thatcher, Bohman, Burks, Henry, Regan, Swierenga, Urban, and Waddell (2002) describe a way to create a link to the text-only pages by using a transparent 1-by-1 pixel image (a GIF file). This image can be placed at the top of the page as a link to the help for screen readers' file. Because the image is transparent, it will not be seen by persons with vision, so the look of the page is unchanged. For persons with screen readers, however, the image is read as the link, and they can easily go to additional information or move about the Web page.

Resources

Validation Tools

Previously we discussed the validation tools *Bobby* (http://www.cast.org/bobby) and *A-Prompt* (http://aprompt.snow.utoronto.ca/). We add them here for completeness of this list, and again recommend them not only to identify accessibility problems but also as an informal tutorial on accessibility and Web page design. We have chosen to highlight these two programs because they are free. There are, however, several commercial products that may be of interest to organizations. These commercial products can help make the corrections.

Bobby (http://www.cast.org/bobby)
Will check your pages once they are posted to the Web. It will compare your pages to both the WAI and Section 508 guidelines. The Bobby Web site will ask you for your Web page address, automatically check the page for accessibility problems and then link you to solutions from the WAI or Section 508. It will not, however, be able to check pages that are password protected. Some HTML knowledge is required.

A-Prompt (http://aprompt.snow.utoronto.ca/)
Will validate your page and provide menus with solutions. Download *A-Prompt* from the University of Toronto then run it on pages that are saved on your computer. Because the pages are saved "locally" *A-Prompt* can check your password protected pages before you post them to the Web. Much less knowledge of HTML is required, although HTML knowledge

is helpful for some repairs. *A-Prompt* finds both WAI and Section 508 errors.

Internet Resources

The Web Accessibility Initiative (WAI; www.w3c.org/wai). Provides detailed guidelines for creating accessible Web pages. Knowledge of HTML is required.

WebAIM (Web Accessibility in Mind; http://www.Webaim.org). Perhaps the best site for tutorials and free information about creating accessible Web pages. They frequently conduct free, on-line training sessions.

Books

Flanders, V., & Peters, D. (2002). *Son of Web pages that suck.* San Francisco: Sybex.

A great book for learning about Web page design by examining bad Web page design. Humorous but highly informative, although it is not about accessibility, per se.

Paciello, M. G. (2000). *Web accessibility for people with disabilities.* Lawrence, KA:CMP Books.

Easy to read and comprehensive. Paciello's book covers the basics from the legal background, through the WAI guidelines, to discussion of Java accessibility programs. It has a good section on disability resources and links to useful software.

Thatcher, J., Bohman, P., Burks, M., Henry, S. L., Regan, B., Swierenga, S., Urban, .D., & Waddell, C. D. (2002). *Constructing accessible Web sites.* Birmingham, UK:Glasshaus.

The credentials of the authors are impressive and this book provides specific suggestions for creating accessible Web pages. This book is more technical than Paciello's but is still easy to understand. It also addresses Section 508 in depth, and contains a new section on Multimedia's Flash MX program. Flash is becoming increasingly popular as a Web authoring tool. They also include a chapter on separating content for presentation.

Additional Resources

Editor's Note: One Web page meeting the criteria mentioned herein is the author's own (http://www.coe.ohio-state.edu/jwheaton).

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